

Mountain Railways.

BY SALVATORE PANNIZZI.

The queerest railroads on the face of the earth, up precipices and over mountains, illustrated by means of startling photos.



WE all love to gaze upon the sublime panoramic view from the top of a mountain, but not all of us have the physical strength or inclination to climb to the top by our own unaided exertions. Hence the mountain railway. The photos. reproduced in this article give a truly admirable idea of these wonderful undertakings; and they enable persons who have never even seen a mountain railway to realize what a curious experience the ascent by railroad really is.

The very first photograph reproduced on this page is a view of the famous railroad up Mount Pilatus, near Lucerne. As every visitor to Switzerland knows, this magnificent mountain stands at a sufficient distance from the chain of Alps to lose nothing of its height by comparison. For many years ladies and others were precluded from the ascent of this rugged and serrated mountain, which looks down so majestically on the beautiful shores of the famous Lake of Lucerne. The summer of 1886 saw the commencement of the Pilatus Railway, which was to take passengers from the delightful little hamlet of Alpnachstaad right up to the breezy Pilatus-Kulm Station, 6,791 ft. above the level of the sea. The Pilatus Railway is nearly three miles in length, and the maximum gradient is 48 in 100. From the lake shore upwards, the foundation of the line consists of a continuous wall of solid masonry, covered with enormous slabs of granite. The ravines and torrent-beds are spanned by arches of masonry, and the rack-rail runs midway between the two smooth rails, but at a somewhat higher level. The locomotive and the carriage, with four compartments, holding eight passengers each, form one piece of rolling-stock. The curious thing about this railway is that, instead of hauling or pulling the carriage, the engine *pushes* it up. Also, the boiler is placed cross-

wise on the engine instead of in the usual manner. The speed, both in ascending and descending, is 65 yds. a minute. Thanks to the extraordinary energy displayed by the contractors, this extremely difficult undertaking was completed in the course of two short summers—little more than 400 actual working days. The first stoppage on the way up is made at the Wolfert Ravine, where a halt is made for the purpose of taking in water. One's glance at this point falls almost perpendicularly down into the Bay of Alpnach. Its waters, fed by the muddy



THE RAILWAY UP MOUNT PILATUS.

torrents descending from the mountain, are not of the intense deep blue colour of the open lake, but of a yellowish-green hue. Steamers passing by beneath look no bigger than walnut-shells. An upward glance reveals the continuation of the railway line at so tremendous a height above, and on a rock of such appalling steepness, that one involuntarily asks one's self whether it is really possible for a train to reach that point, which appears beyond the power of even an eagle. Arrived at length at the summit, one gazes with astonishment and awe into the frightful abysses and precipitous valleys, and towards the beautiful country between the mountain itself and Lucerne. Beyond the town stretches the lovely hill district of Central Switzerland, with its countless villages, its blue lakes, and its rivers wandering like silver threads among the forest-crowned ridges that intersect the spacious plain.

Including rolling-stock, station buildings, and workshops, but excluding hotel buildings, the Pilatus Railway was completed by the contractors for the very modest sum of 19,000,000 francs, or £76,000.

Next is shown a very impressive view on the Glion Cable Water-Balance Railway, in Switzerland. This line runs from Montreux to Glion on Lake Lemman. The rise of this little railway is 997ft., and its maximum grade is as great as 57 in 100.

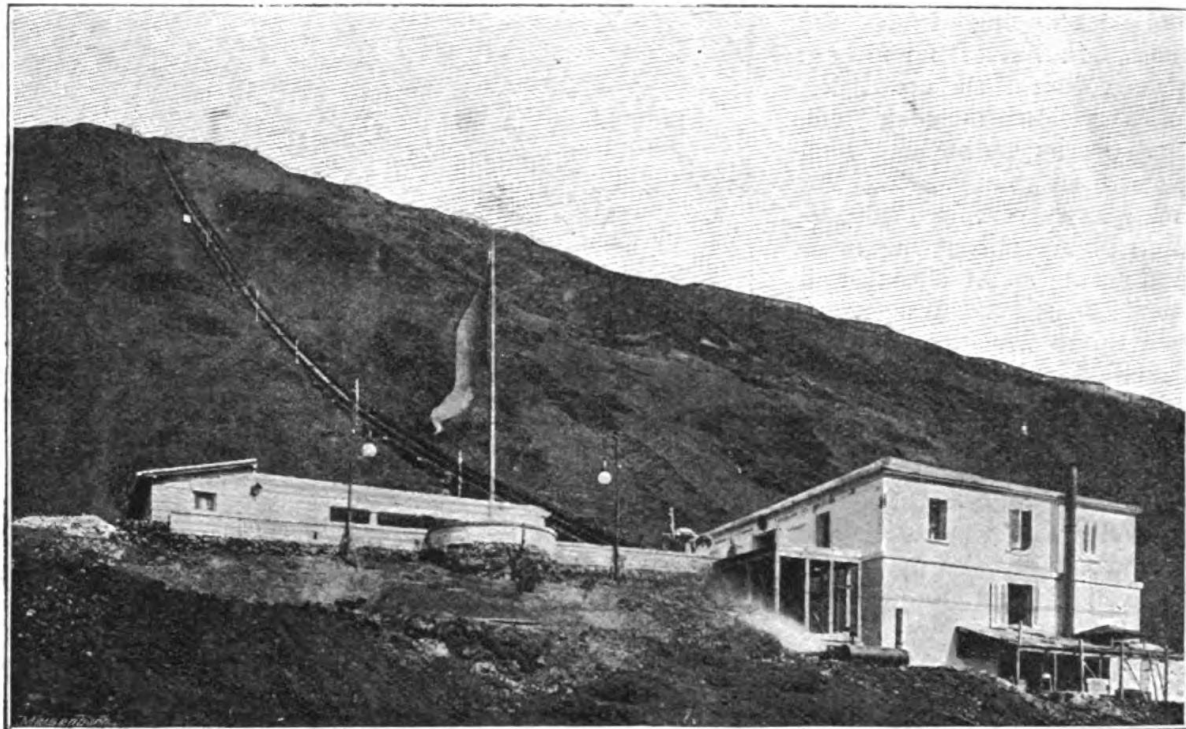
The simplest form of the cable incline is the water-balance; and when Nature favours and provides an ample water supply at an elevation equal to that of the upper terminus of the road, no other system can be employed with like economy. The old-time well, with its rope passing over a pulley and a bucket attached to each end—one bucket coming up as the other goes down—illustrates the principle very well, except that in the case of the incline the water is at the top, and in going down raises the "bucket" (which is the car) at the lower end by its weight. To the ends of the cable passing round the sheaves at the top of the incline two cars are attached, provided with water tanks, capable of being rapidly filled or discharged.



VIEW ON THE MONTREUX-GLION LINE.

The difference in the weight of the ascending and descending loads, together with friction, is all that has to be overcome.

The upper car is made the heavier by filling its tanks with water. In its descent it raises the lower car, and upon arriving at the bottom it discharges its load of water, preparatory to receiving its load of passengers and freight. The water required is used to augment the weight of the descending car, so that it will overbalance the ascending load, the rapidity of motion being controlled by friction brakes. The Glion Railway from Montreux is prepared exactly on this principle. The trip from the foot to the summit of the incline is made in seven minutes. The construction of the railway is



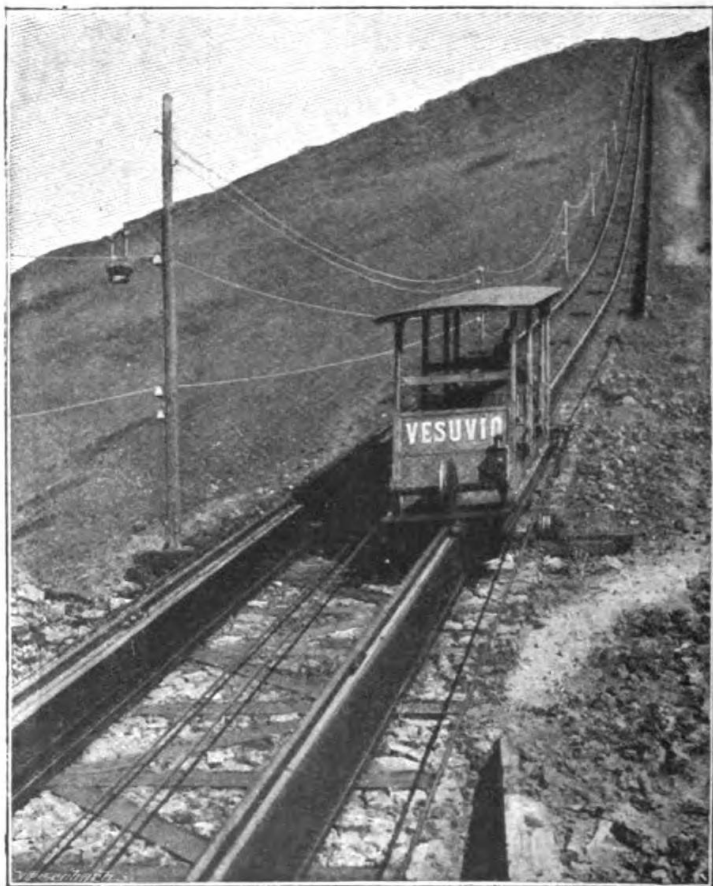
VESUVIUS RAILWAY—THE LOWER STATION.

most thorough, the track being supported on arches of solid masonry in many places. About half way up, the line crosses on a viaduct the ordinary highway which skirts the mountain side. There are many smaller water-balance inclines in Switzerland. At Niagara, too, a short water-balance incline runs down close below the Falls, on the Canadian side, to the Whirlpool Rapids.

The idea of a "climbing" railway is not exactly a thing of yesterday. As long ago as 1812 such a system was used in England on the road between Leeds and the Middleton Coal-pits. In 1870 Riggensbach built the famous road up the Rigi, from Vitznau, and many others followed.

We next reproduce two views on the wonderful little line that ascends to the very crater of Vesuvius, and which is the private property of Mr. John M. Cook, of the world-renowned firm of tourist agents. This is what is called a "funicular" railway, and it has two inclines, the one a continuation of the other. Lately, the permanent way has been strengthened, and new stationary engines, new wire cables, and improved cars have also been provided. The fare charged from Naples to Vesuvius and back includes the services of a guide on the mountain to insure proper attention and assistance for the short distance of about 150yds. from the upper station of the railway to the crater; and any passengers requiring special help for this little journey,

through physical weakness or other cause, can be provided with an extra guide or with a *chaise à porteur*. The lower station seen in the photo. is 861yds. above the level of the sea, and the elevation of the upper station, 1,295yds.



VESUVIUS RAILWAY—ON THE WAY UP.

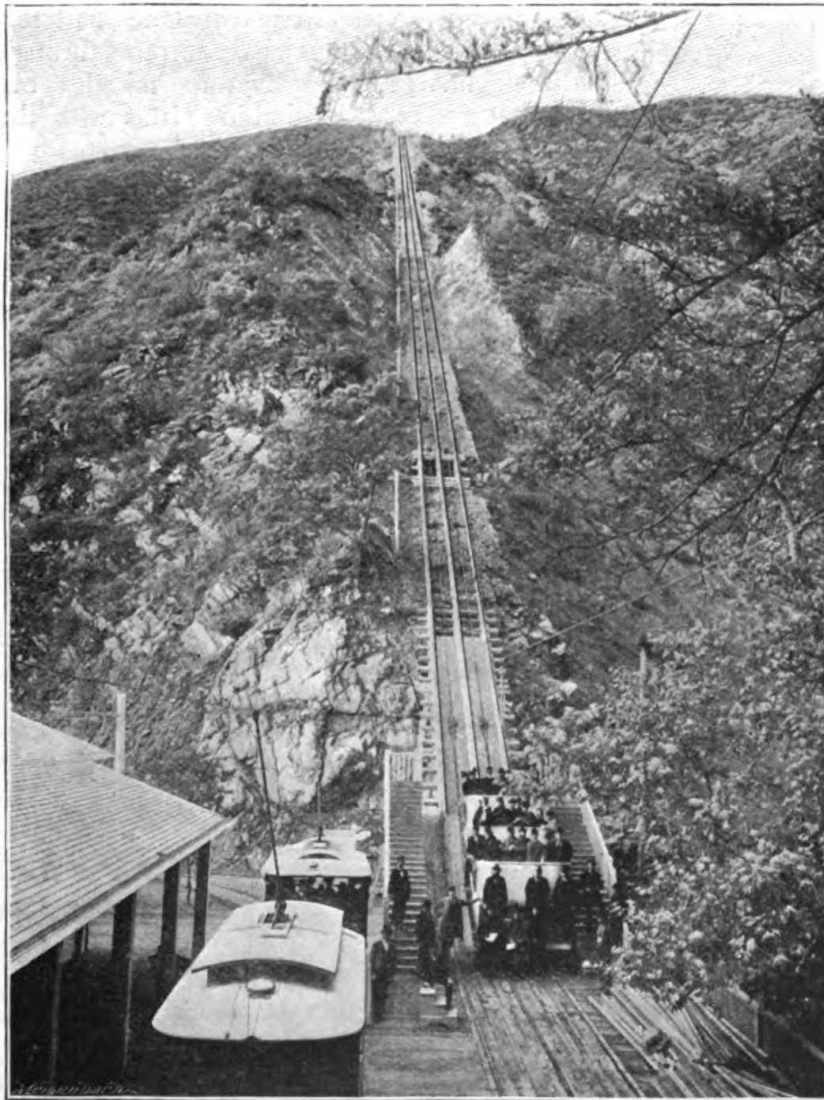
The total length of the line is 896yds., the maximum incline being 63deg. Carriages conveying passengers to the lower station leave Cook's office in the Piazza dei Martri, Naples, at seven o'clock in the morning in the summer, and the fare of 25 francs includes one seat in the carriage and on the railway, and also the services of a guide to the top of the crater. Our second photo. shows the car fairly on its way to the summit.

But it must not be supposed that Europe has a monopoly of these extraordinary "railways on end." Just consider for a moment the next photo. we reproduce, which shows us the great cable incline on the Mount Lowe Railway in California. It is quite an interesting story how the Sierra Madre Mountains have been surmounted by electric cars, and the most sublime views of mountain, valley, and ocean scenery made accessible to all. This extraordinary system owes its existence to Prof. T. S. C. Lowe, who passed his boyhood among the mountains of New England, and afterwards

became a famous figure in Southern California. The mere list of Prof. Lowe's inventions would fill a column, so we must start with the year 1889, when preliminary surveys were made in connection with the Professor's greatest project. The railroad starts from Altadena, a beautiful residential suburb about four miles from Pasadena, from which town the electric railway climbs boldly over the high *mesa* and up Rubio Canyon, a distance of 2½ miles. At the canyon one reaches the foot of the great cable incline shown in the photo. This incline extends from the Rubio Pavilion, 2,200ft. above the sea, to the summit of Echo Mountain, 3,500ft. high. The extraordinary railway track we are looking at is about 3,000ft. in length, and makes during the distance an ascent of 1,400ft. The gradient begins at 62 in 100—a rise of 62ft. in going forward 100ft. ! The cars are permanently attached to endless cables, and are so balanced that in ascending and descending they pass each other at a "turn-out" exactly midway, and are so arranged as to keep pas-

sengers always on a level, regardless of the steepness of the track. Also, they are uncovered, so as to offer a perfectly unobstructed view in every possible direction — no canopies even being needed in a land having 320 days of fair weather in the year. The cable itself is of the finest steel, and was thoroughly tested to a strain of 100 tons ; and as, under any circumstances, the loaded cars will never exceed five tons, its absolute safety is at once apparent. Seen from below, Echo Mountain appears a mere abutment from the main range, but when one stands on the summit one sees that it is separated by canyons half a mile wide and over 1,000ft. deep. The outlook from the top of Echo Mountain, 3,500ft. above the level of the sea, is unequalled, ranging as it does over mountains and verdant valleys, cities, towns, villages, old missions, sea-beach, islands, and the limitless ocean.

The next photo. reproduced shows a loaded freight-car on its way to the tri-crested summit of Mount Lowe. On the crest of Echo Mountain is one of the best-equipped mountain hotels in the world. The sunrise and sunsets viewed from this point are indescribably sublime, and besides,

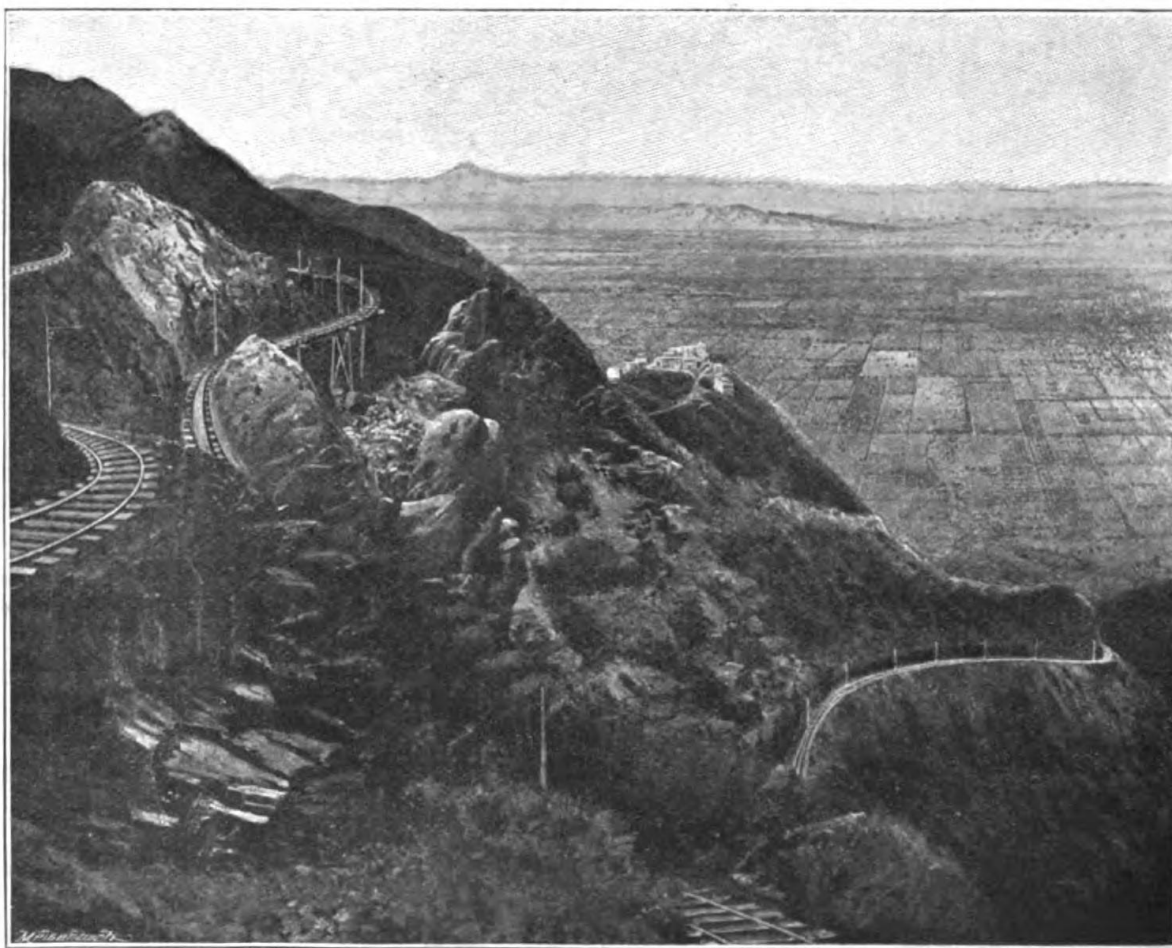


GREAT CABLE INCLINE, MOUNT LOWE RAILWAY.

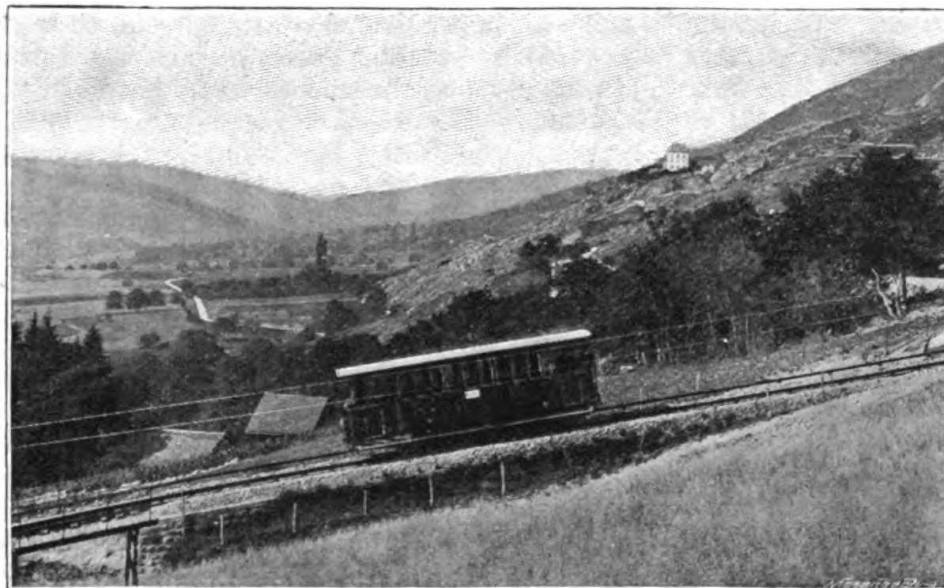


NEARING THE SUMMIT OF MOUNT LOWE.

there are many other attractions in the "City on the Mount," including the great observatory, and the famous search-light of three million candle-power. There is even a menagerie and concert-hall up here! The third photo. we reproduce of the Mount Lowe Railway shows the extraordinary windings of the line. We also see the "City on the Mount," on the lower peak, and we are looking away over a vast stretch of country which is laid out like a chess-board. It would seem that the whole of Southern California is stretched out before the spectator. Distant Catalina Island, and the more remote chain of islands, and Santa Barbara, too, draw near in the clear atmosphere, and the numerous cities which bestud the plain appear close by, while the high peaks of the Sierras stand out against the sky with startling vividness. To quote from the descriptive pamphlet handed to passengers: "The vast depths of Millard and Grand Canyons serrate the mountain as if the plough-shares of God had furrowed a path for the winter torrents through the solid granite. Nature mingles her softest and most bewitching vistas with the



VIEW FROM THE SUMMIT OF THE MOUNT LOWE RAILWAY



From a Photo. by]

ASCENDING SALÈVE MOUNTAIN.

[J. Jullien, Geneva.

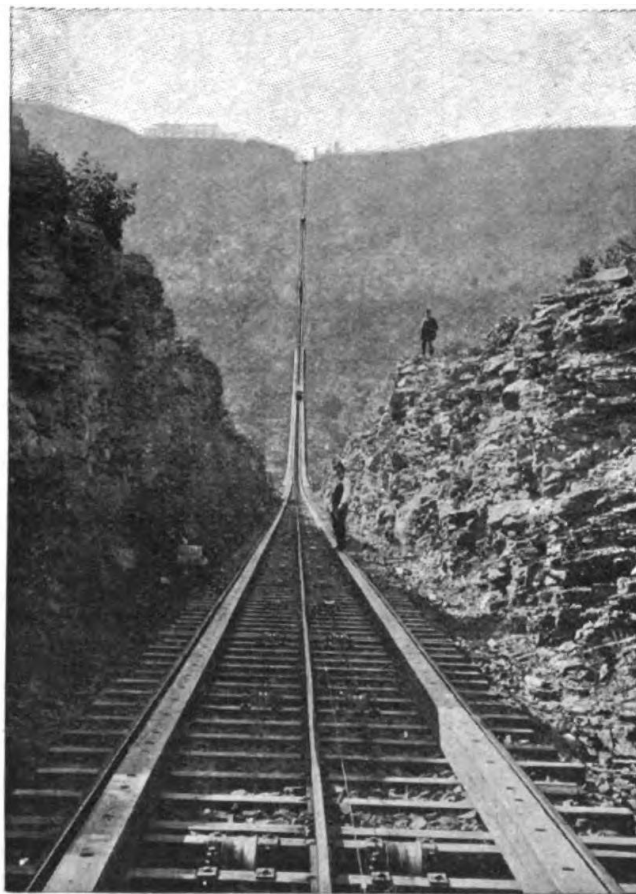
stern grandeur which pervades the mountain heights, and the broad expanse of sea which ultimately unites with the distant horizon." The present terminus of the Mount Lowe Railway is 5,000ft. above sea-level, and from this point the summit of the mountain itself can be seen towering 1,000ft. above. The hotels and buildings on Echo Mountain are seen from this point as the playhouses of children; and the orange groves and vineyards and green grainfields in the valleys resemble a variegated patchwork upon an old-time quilt.

We next turn to the electric railway up Salève Mountain, near Geneva. The photo. we reproduce shows the trim electric car fairly on its way up. Those who have not experienced a ride up a mountain in this way find it difficult to realize the extraordinary pleasure of sitting at one's ease in a carriage and watching the illimitable panorama of country continually growing wider and wider every minute. It is curious, too, to feel the air getting colder and colder; and there is no doubt an element of danger in this, since inexperienced people often fail to provide themselves with suitable wraps, forgetful of the fact that whilst at the starting-point the heat may be perfectly insupportable, yet at the terminus of the railway the air may be so keen as to nip one's ears and make one shiver with cold.

The idea of making a railway up Salève Mountain (Haut Savoie) is not exactly new, because it was in 1877 that permission was granted by the French Government for the construction of a line similar to the one up the Rigi. It was not until 1891, however, that the project took concrete form. The whole of the line is in French territory. The total length of this railway is 9,100 mètres; and as one ascends the steep sides of the Petite Salève,

one obtains a most ravishing view of Lake Lemman and the villages of the Bas and Haut Mornex. Each carriage takes forty passengers at a time, and weighs eight tons. The cost of the Salève Railway was not excessive, and the authorities have worked it out at 50fr. for each mètre (about a yard) of the line. The average speed on this mountain railway is six kilomètres an hour. The total cost of the line was 2,300,000fr., and it was completed in two and a half years.

We have next to consider some extremely impressive views on the Otis Elevating Railway in the Catskill Mountains, New York State. The Otis line is in direct communication with the Catskill Mountain Railway. In our first photo. we are looking directly up the great incline, 7,000ft. in length. In this distance the line rises 1,600ft., and attains an elevation of 2,200ft. above the Hudson River. In length,



LOOKING UP THE GREAT INCLINE, OTIS ELEVATING RAILWAY.

From a Photo. by Loefler, Tompkinsville.

elevation overcome, and carrying capacity, the Otis Elevating Railway exceeds any other "incline" system in the world. It was built and first opened for traffic in 1892. It is operated by stationary engines and steel-wire cables, which pass round enormous drums located at the summit of the incline. Thus, when one train ascends the other descends, the trains passing each other midway. By this arrangement, a train carrying from seventy-five to 100 passengers can be run in both directions every fifteen minutes when necessary. The time required for the trip is only ten minutes.

The next railway to be considered is the famous line up Pike's Peak in Colorado. After numerous routes had been opened or attempted to reach the summit of Pike's

miles a comparatively level stretch is to be seen, covered by beautiful groves of pine and aspen. In the distance, the smooth, round head of Bald Mountain elevates itself. To our left is the castle-shaped Sheep Rock, and just beyond is Lion's Gulch, where we get the first grand view of the majestic and imposing proportions of historic old Pike's Peak—the Father of Manitou.

Now we reach a steeper incline, and are soon at Timber Line, 11,578ft. above the sea-level. A sharp turn is made, and we have passed Windy Point, and are fast climbing into the Saddle. From this point a superb view of Manitou, the Garden of the Gods, and the plains to the east may be had, while to the left are hundreds of snow-mantled peaks, which make up the Continental Divide. Seven thousand five hundred feet more and we have reached the



From a Photo. by

GOING UP PIKE'S PEAK.

[J. H. Hiesband, Manitou, Col.]

Peak, the Manitou and Pike's Peak Railway was finally completed in 1890. It is built after the patents of M. Abt, of Lucerne, and is a combination of the ordinary "T" rails and the rack or ladder rail, which is made of the best Bessemer steel, having teeth cut from a solid piece by specially-constructed machines for that purpose. The road-bed is from 15ft. to 22ft. wide, and the line of track is on solid rock for a good portion of its length. There are no trestles, and but four bridges on the line, which are permanent structures of stone and iron. To prevent the moving or sliding of the track, 146 anchors are firmly set into the solid rock, varying in distance apart from 200ft. to 600ft., according to the grade.

The exact length of the road is 46,992ft., and the average elevation overcome 844'8ft. to the mile. Passing the Half-Way House, we go up through the narrow, rugged walls of Hell Gate, and enter Ruxton Park, where for two and a quarter

upper terminal, the old Government Signal Station on the long-talked-of summit of hardy old Pike's Peak.

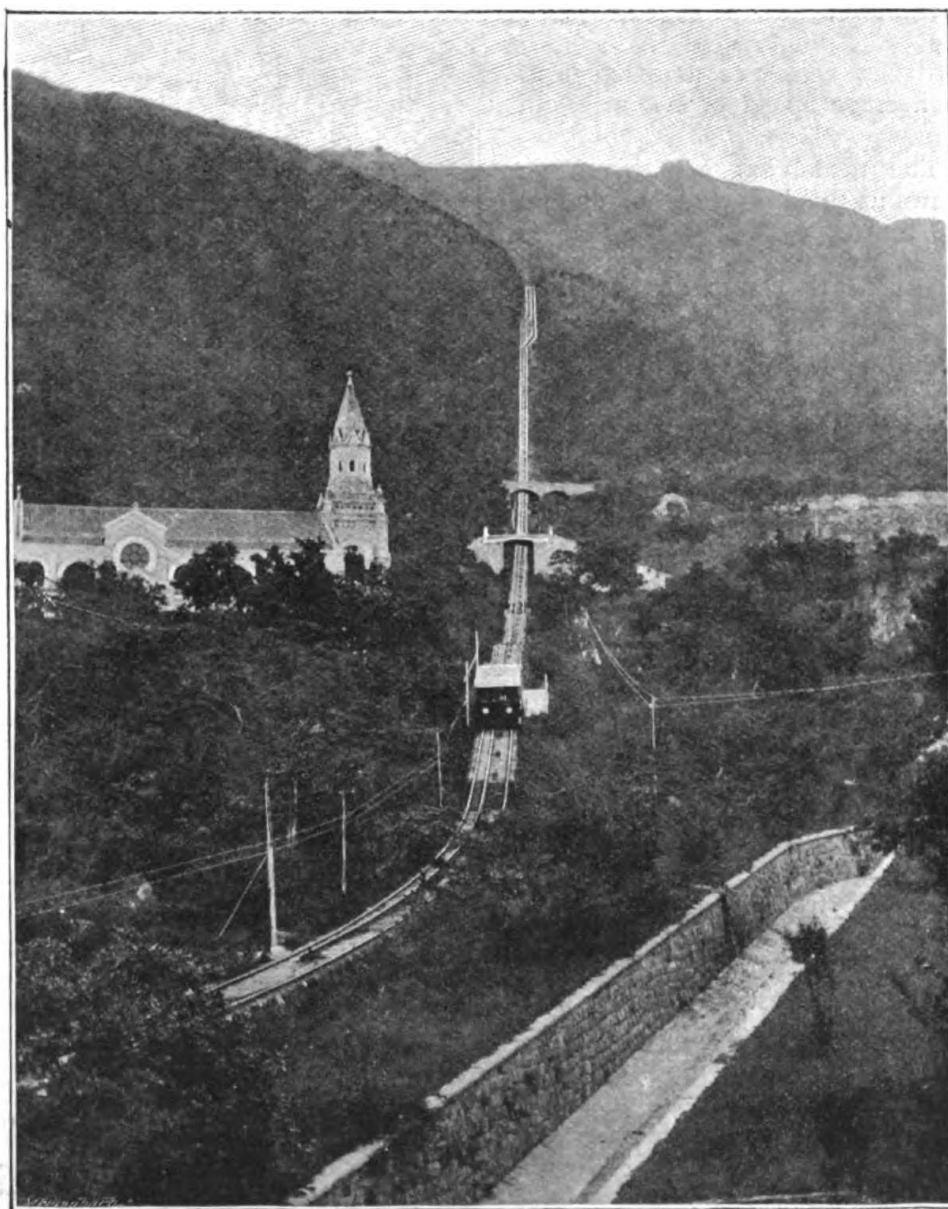
The traveller who now makes the ascent of Pike's Peak in comfort by its wonderful railway does not appreciate the amount of study devoted to the difficult problem by the best engineers and mechanics, or the perils and hardships attending the survey and construction of the road. Camping out, clambering over mountains covered with fallen timber and jagged rocks, the occasional intense cold, terrible snow-storms, fearful winds, and the difficulty of getting provisions, made this undertaking almost beyond conception.

Of course, it is impossible for us to deal with every mountain railway in the world, big and little, in this brief article, for their name is legion, and their number—like the giant in the show—"still growing." There are probably scores of them, and they range in importance

from the little line at Lucerne, which ascends the hill known as the Gutch, some 300 and odd feet in height, right up to (in a very literal sense) the Oroya Railway of Peru, an adhesion line which attains a height of 15,720ft. above sea-level. Then there are projects to conquer the Jungfrau, and even stately Mont Blanc itself; but whether they will ever come to fruition is a matter as yet undetermined. Curiously enough, many of the smaller lines make the most impressive photos.; and this statement is borne out by the next photo. reproduced, which is a very fine view indeed of the "tramway" in Hong Kong. Only recently has this rugged island, with its gardens, its great Peak, and all its wondrous beauty, had any system of transport for the conveyance of passengers and luggage; and this notwithstanding the enormous population of the island. At the time we have in our mind there were not probably half-a-dozen horses in all Hong Kong, and the carriage of goods was done entirely by native porters, who were employed in thousands. Passengers were carried in Sedan chairs by natives. The great Peak up which the tramway goes is from 1,700ft. to 2,000ft. high; and there are many more rugged peaks of rather less importance.

Not everyone is aware that we have, even in England, a mountain railway of the most approved type. We allude, of course, to the railway up Snowdon, in North Wales, which opened under such disastrous circumstances a few Easters ago. There are five or six different paths used for the ascent of Snowdon by pedestrians, but the Snowdon Railway provides an entirely new route. The climb by rail is decidedly economical when compared with the journey on foot. In the latter case, the charge is usually 10s. for a pony and guide; but

for half this sum the tourist can now be carried in safety and comfort to the summit of the mountain, and back again to Llanberis. The ascent commences by a straight run westward along a gradient of one in fifty for about 300yds. On rounding the high point of Llechog, one sees a break on the left, through which is obtained the first view into Llanberis Pass. Looking down almost perpendicularly from a rugged plateau to the bottom of the valley we see the high road and a streamlet, just 2,000ft. below. The photo. we reproduce shows the last stretch of the line at the summit, 3,560ft. above the level of the sea. Altogether, the Snowdon Railway is $4\frac{5}{8}$ miles long, and cost, including rolling-stock, land, and other expenses, £13,617 per mile. The worst gradient is 1 in $5\frac{1}{2}$. The locomotives, which are of 166h.p., can each drive before them up the mountain two



THE "TRAMWAY" UP THE PEAK AT HONG KONG.

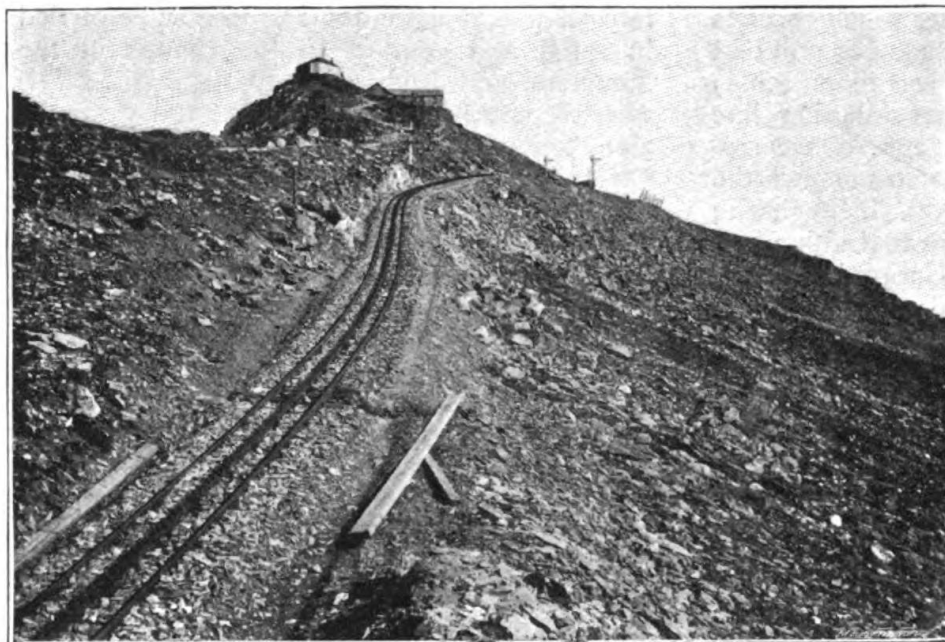


Photo. by the]

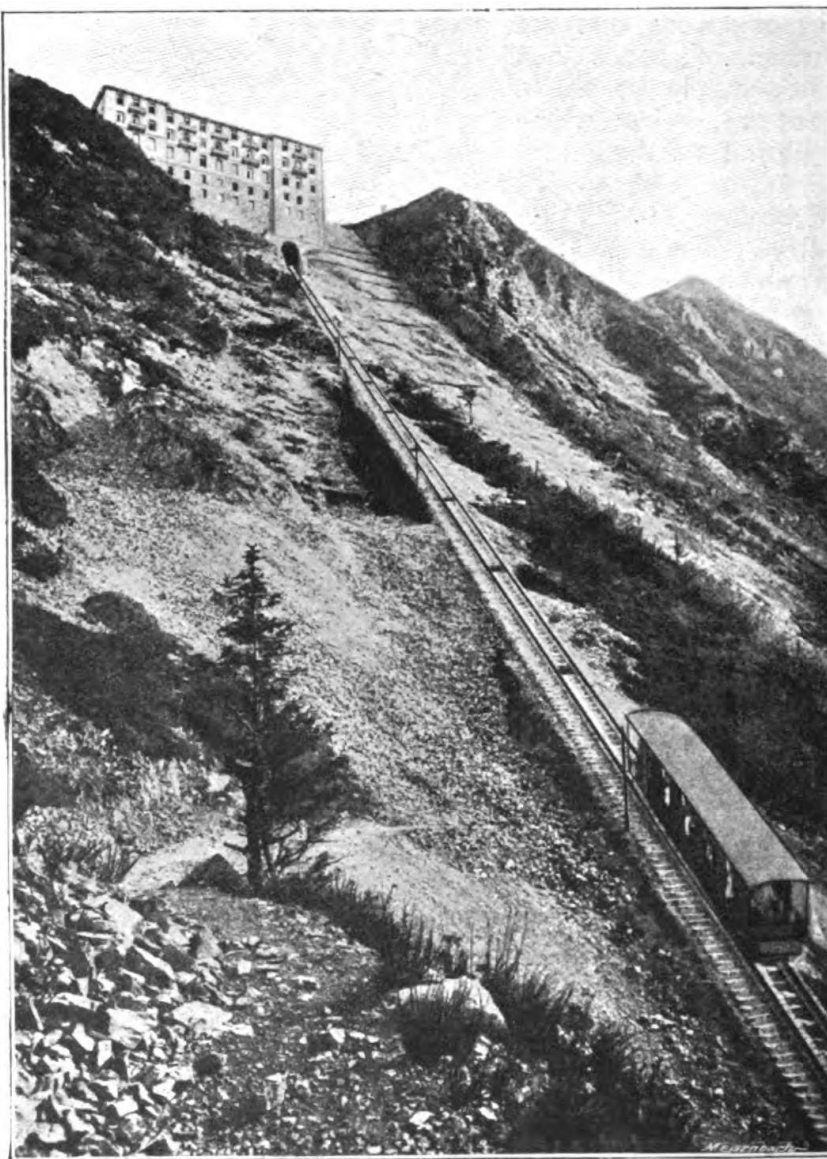
THE SUMMIT OF THE SNOWDON RAILWAY. [Photocrom Co., Cheap, sile.

Mine, in Tasmania. For three and a half miles from the North Level the line passes along the northern side of the Linda Valley. The total length of the line is a little over thirty miles, and the maximum grade is better indicated in our photo. than it would be by any mere figures. This is a view of the northern end of the open cutting of the mining company's railway, and it shows the eastern incline of their haulage line. This railway runs from the mine itself to the nearest port, and of

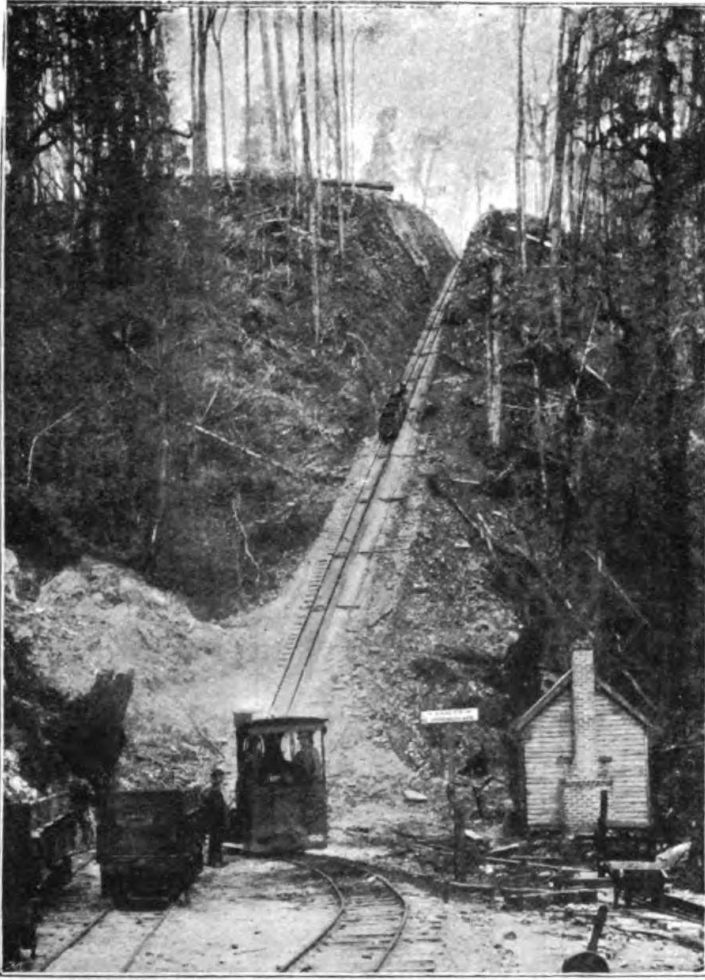
carriages, with 112 passengers, at an average speed of five miles an hour.

The next view on this page shows us the last steep bit before the summit of the Stanserhorn is reached. The slopes of this well-known mountain on the Lake of Lucerne are clothed with beautiful pastures and noble forests, and its summit attains an altitude of 6,233ft. above sea-level. The maximum gradient of this most picturesque line is 60 in 100. The total length from the village of Stans to the station near the summit is $2\frac{1}{3}$ English miles. This is an electric railway, and the cog-rails are conspicuous by their absence, their place being taken by a highly ingenious system of brakes. The view from the summit is indescribably grand, embracing the entire range of mountains from the Sentis to the Bernese Alps. The line is open for traffic from the beginning of April to the first part of November.

These interesting "railways on end"—small editions of them, that is—are even found in the possession of private mining and other companies. One of the best examples of this form of line is the one next shown, which belongs to the famous Mount Lyell Gold



THE LAST STEEP BIT ON THE STANSERHORN RAILWAY.



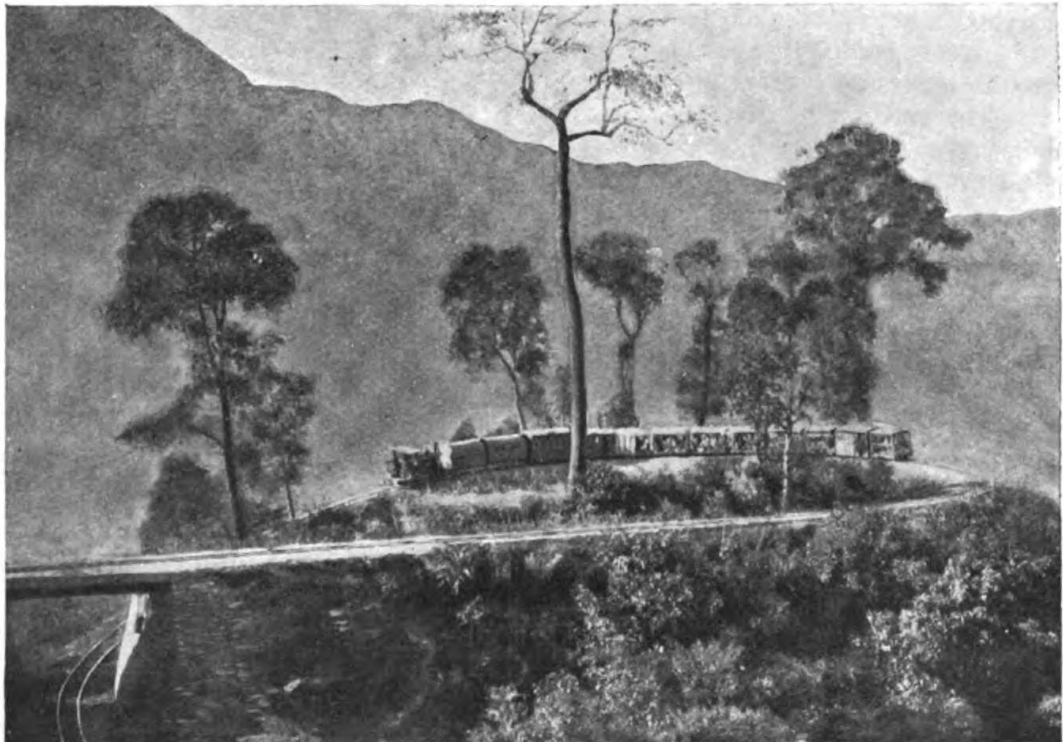
THE HAULAGE, MOUNT LYELL RAILWAY.

course forms a most valuable asset of the company. Notwithstanding its steep gradients and its length, the line has not been affected by the severe weather prevailing in the "Saddle," nor has any trouble ever been experienced with the winding engine. The line has been extensively used for the carriage of machinery, including, for instance, a large 70h.p. boiler complete. Over this line the ore is carried in large quantities to the smelting houses and furnaces.

The next photo. we reproduce is a

view on the wonderful Darjeeling-Himalayan Railway in North India. From Calcutta one comes to the terminus of the North Bengal Railway at Silliguri Station, and from thence to Darjeeling the journey is continued on the famous Himalayan Hill Railway, which has a gauge of 2ft. The distance from Silliguri is fifty-eight miles, and the time occupied eight hours. The line is constructed in the most substantial manner, with heavy steel rails, weighing 40lb. to the yard. The little locomotives, specially designed by Messrs. Sharpe and Stewart, of Manchester, weigh ten tons. The speed, both up and down, is not allowed to exceed seven miles an hour. By the present speed, travellers ascend 1,000ft. an hour. At about fifteen miles from the starting-point the train enters the most sublime scenery—lofty trees and masses of jungle, with gorgeous tree-ferns at the higher altitudes. Presently the cars pass round a spur of a mountain, and the line runs on the very edge of a precipice 1,000ft. deep. Darjeeling itself is perched on a narrow ledge 6,000ft. above the bed of the Great Ranjit River. In the distance tower the colossal Himalayan giants Everest and Kinchinjanga, each about 29,000ft. in height. Thus, the Darjeeling Railway commands the sublimest mountain scenery on the face of the earth. The photo.

we reproduce shows a loop in the line. The train can be distinctly seen descending from



THE WONDERFUL HILL RAILWAY, DARJEELING.

the higher to a lower level. It is going under the bridge over which it was rushing a minute or two before. There are many such loops at different points of the track, and the twisting and turning of the line add considerably to the interest of the trip from Calcutta. Indeed, so extraordinary is this railway that we have in preparation a very complete article upon it, illustrated by means of photos.

The last mountain railway we have to deal with is, perhaps, the most extraordinary of all, the motive power being not steam, nor electricity, but a *balloon*! Stranger still, the official stamp of approval has just been put upon this most marvellous railroad, which goes to and from the summit of Hochstauffen Mountain at Bad-Reichenhall, the well-known watering-place in the Austrian Alps. The Aero-static Railway—to give it its correct designation—owes its inception to the well-known inventor, Herr Volderauer, who had long ago convinced the experts that his scheme was perfectly feasible and safe. A single rail guides the cars, and keeps the bal-

loon with its load captive, the cars gripping the rail at the sides and underneath the flange. At about every 15ft. the line is firmly anchored. In descending the mountain, of course, gravity is the propelling force, water-ballast being taken aboard at the upper end to counterbalance the buoyancy of the balloon. The cock on the water-tank of the car can be opened by the operator at any time. The tank carries about 800lb. of water, and tank and car together weigh about 600lb.

The balloon is 67ft. in diameter, and exerts a lifting capacity of something over 11,000lb. Weights, also, can be taken aboard and discharged at the various stations along the line. At the foot of the track are the gas-tank and generator. The summit of the Hochstauffen offers a sublimely beautiful view; but before the advent of the Aero-static Railway the climb was both long and tedious. It was only attempted by experienced mountaineers. The extraordinary nature of the undertaking may be realized from our illustration, which shows the balloon dragging up its car on the single rail.



MOUNTAIN RAILWAY WORKED BY A BALLOON, IN THE AUSTRIAN ALPS.

[We desire to gratefully acknowledge the valuable assistance rendered by Messrs. Thomas Cook and Son, the world-renowned tourist agents, who have collected together the photographs reproduced in this article.]